Alternatively the nozzle plate may be bolted to a separate nozzle box, which in turn is bolted against an opening at the end of the top half of the casing.

The fixed blades for the remaining stages are cast into split diaphragms, which carry distance rings at their periphery so as to provide the necessary spacings for the revolving discs let into the casings and butting against each other.

The diaphragms are usually dished to give the required strength, and are formed with openings in the centre through which the shaft passes, the inside periphery being provided with baffles which give a running clearance for the shaft and prevent excessive leakage losses across the annular clearance spaces between the diaphragms and the shaft. In all but exceptional designs the diaphragms are made in two halves, with a tongue and groove joint along the horizontal plane. The upper halves of the diaphragms are fastened to the top half of the casing, so that when this part has been lifted the rotor can be examined or taken out as a whole.

Casing.—The casing is generally made of cast iron, but where high superheats are used it is desirable to split the casing vertically and make the high-pressure end of cast steel, or, where the nozzle-box construction is adopted, to make the latter of cast steel.

Couplings.—Continental designers largely prefer the use of solid couplings between the turbine and the driven machine, but flexible couplings are usually adopted in this country except on small units.

The flexibility of such couplings is limited, but suffices to take up the movement of the shaft ends due to their normal deflection. The desirability, amounting in practice to necessity, of enclosing the coupling at turbine speeds, and the consequent impossibility of avoiding the presence of hot-oil vapours, prohibits the use of leather, which is generally considered the best driving medium in a flexible coupling. A large number of designs have been tried from time to time, but the simple steel-claw type and the tooth type have now become more or less standardized.

Heat Expansion.—Provision has to be made in all turbines for taking up the expansion of body and rotor. The large and often

rapid variations in temperature which occur with variations of load, and especially when changing from condensing to non-condensing and vice versa, have given rise to great difficulties, and it is probably safe to say that the largest number of breakdowns to turbines have owed their initial cause to unlooked-for movements or distortions of body or rotor due to temperature variations. To minimize this danger the design should embody rigidity at fixed points, and easy sliding surfaces where expansion is intended to take effect. At the same time, symmetry and simplicity of construction of the body casting, and absence as far as possible of sharp changes in diameter or of unnecessary ribs or attachments, are matters calling for close attention. It is, of course, of primary importance that expansion should not affect the alignment of the plant.

Blades, Materials, and Wear.—The blades of reaction turbines,